Network Technologies Employed. Small study areas with less than 10,000 lines have an average of over two times higher switching investment per MOU than study areas with more than 50,000 lines:

Number of Access Lines in Study Area	Switching Investment	
	per Line	per MOU
Less than 10,000	$509	$.039
10,000 to 20,000	$450	$.031
20,000 to 50,000	$407	$.026
Under 50,000	$464	$.033
Over 50,000	$330	$.018

Source: 1992 NECA Data.
1990 Armis, 1990 Network Usage, 1990 Cost Studies

Some small LECs are bearing relatively high costs for extensive network upgrades, as indicated by telephone plant under construction per access line. At year end 1991, the REA LECs reported $71.71 per access line in telephone plant under construction.[31] In contrast,

31 REA Report at xxxii, xxxiv.

BOCs reported $29.50 per access line in telephone plant under construction.[32]

In the absence of industry support mechanisms, small and rural LECs would have far greater difficulty financing network upgrades, such as digital switches, because these upgrades are more costly on a per line basis in small service areas. For a central office serving 500 access lines (median size of NECA LEC switches), the cost per access line of a new digital switch with equal access and SS7 capabilities is approximately 4.2 times greater than an office serving 10,000 access lines (average size of Tier 1 LEC switches).[33]

Dependence on Toll and Access Revenues. Smaller LECs are far more dependent on revenues from toll and access services in covering their high costs per access line and enabling them to charge reasonable local rates:

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32 FCC Report at 17, 26.

33 1992 NECA Data.

Group	Toll and Access Revenues as a Percent of Operating Revenues	Local Service Revenues as a Percent of Operating Revenues
BOCs	44.2*	47.2*
REA LECs	65.7**	25.0**

Source:

* FCC Report at 39-40.

** REA Report at xxxvi.

The higher costs faced by small LECs force them to charge IXCs higher access rates, which increases the risk of bypass and can cause IXCs not to offer certain services in rural areas:

Comparison of Switched Access Rates Filed for July 1992			
Rate per MOU	NECA	Tier 1 Average	Rate Disparity NECA as % of Tier 1
Local Switching	$0.0450	$0.0111	405%
Local Transport	$0.0167	$0.0108	155%
Total TS Switched*	$0.0620	$0.0223	278%
Total Switched Access (including CCL)	$0.0709	$0.0315	225%

* Includes all TS switched rate elements. Half of this disparity is due to DEM (Dial Equipment Minutes) weighting.

Source: 1992 NECA Data

An example of small LECs' vulnerability to bypass is provided in Appendix C.

To encourage rural infrastructure development and to prevent bypass, the USF and other mechanisms must be structured so that small LECs can maintain reasonable rates for access and local services.

Appendix B

Rural and Urban Statistics

	RURAL	URBAN
People per square mile **	18.80	332.30
Per capita income **	$10,904	$15,442
Income available per square mile to support telephone infrastructure (people per square mile X per capita income)	$204,995	$5,131,377
Physicians per 100,000 residents	97	225
Percent of population 65 years and older*	13.80	11.30
Percent of people below poverty level**	16.80	12.10
Percent of people with high school degree**	69	77
Percent of people with college degree**	13	23

Source:

* <u>State and Metropolitan Area Data Book</u>, U.S. Dept. of Commerce, Bureau of the Census (1991).

** U.S. Dept of Commerce, Bureau of the Census (1990).

Appendix C

The Vulnerability of Small LECs to Bypass: Example

Small LECs are especially vulnerable to bypass through special access arrangements because they have substantially smaller customer bases. The loss of a single large customer may cause an enormous and devastating loss of revenue, which would force a small LEC either to (1) cut back on critical investments needed to maintain and upgrade its public switched network or (2) recoup the revenue from remaining access customers through substantial rate increases (thereby increasing the incentive for additional bypass) or from local ratepayers. It will be impossible for small LECs to maintain reasonable rates and deploy new technology if the customer base over which small LECs recover the costs of the local network is permitted to continue to erode.

Decatur Telephone Company ("Decatur") in Decatur, Arkansas provides a good example of small-LEC vulnerabilities. Decatur has only 811 access lines. Decatur's 175 business lines comprise about 22 percent of its access lines.

Decatur's single largest customer represents 37% of its business lines and 8% of its total lines.[1] It also dominates Decatur's switched originating minutes:

Type of Service	Largest Customer as Percent of Decatur's Total
IntraLATA orig. conversation minutes	18%
InterLATA orig. conversation minutes	25%
Interstate orig. conversation minutes	19%[2]

Thus, if Decatur lost its largest customer, approximately 20 percent of the company's switched originating intrastate and interstate minutes could be removed from the traffic factors used for the recovery of costs from the intrastate intraLATA toll pool, the intrastate carrier common line pool and the interstate pools.[3] In a bill-and-keep access

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1 Exhibit CCM-1, In the Matter of a Proposed Volume Incentive Pricing Service Tariff Filed by Decatur Telephone Company (March 6, 1993) ("Decatur Exhibit").

2 Decatur Exhibit.

3 Testimony of Elaine B. Strassburg, In the Matter of a Proposed Volume Incentive Pricing Service Tariff Filed by Decatur Telephone Company at 4 (March 6, 1993).

environment (i.e., no pooling), such a loss would cause the company to lose 20 percent of its intrastate access and billing and collection revenues. The monetary impact on Decatur and its customers would be significant:

	Loss Per Year	Monthly Loss Per Customer
Total Revenues:	$50,000	$5.75
Billing & Collection:	$13,000	$1.50[4]

[4] Decatur Exhibit.

Appendix D

Efficient Component Pricing ("ECP")

The unbundling approach to local exchange competition relies on all carriers obtaining access to the incumbent LEC's network facilities on a "nondiscriminatory basis." This is generally taken to mean that competitors are given access to service components in such a way that they are not disadvantaged relative to the incumbent. In practice this condition has been interpreted to refer both to the technical characteristics of the access provided as well as the rates charged for it. While technical issues can be both important and complex, our analysis here will focus on pricing issues.

Consider a firm, regulated or not, that is the sole producer of one service component (call it "switching"). To complete the production of the final product it markets to consumers requires the provision of another, more competitive service component (call it "transport"). In the absence of competition the LEC would sell its final service at a markup over the sum of the marginal costs of the two component services. This markup might be thought of as a "contribution" the final service makes to covering the LEC's fixed costs and any social welfare obligations it is required to finance from the revenues it generates from the services it sells.

In a competitive environment, ECP requires that the LEC sell its switching service to its transport competitors at a price equal to the marginal cost of the service it alone supplies plus the contribution the final service makes to its overhead expenses, profits, and social welfare obligations. Pricing less-competitive (assumed to be monopoly) service components in this manner ensures that only firms able to provide competitive services at the same cost as the LEC or less will enter the industry.

A customer can either purchase the incumbent firm's transport services, the initial situation, or it can choose to purchase transport service from one or another recent entrant. In either case, the customer would combine the incumbent firm's less competitive component (switching) with transport in order to obtain the complete product, "local exchange service." On what basis would a customer use another carrier's transport service? Clearly, customers would choose to use the transport component from the incumbent firm's competitors *if and only if* the competitors could provide the component more cheaply than the incumbent firm could provide that component itself. For the case of perfectly competitive transport markets this would be the case if and only if the competitive downstream firms were able to produce the transport component more cheaply than the incumbent could do so itself. But this is just the decision rule that would result from pursuing the objective of social cost minimization for the entire service!

This is a very significant result, for it demonstrates that there need be no inherent conflict between the pursuit of profits by the LEC on the one hand and the goal of socially cost efficient provision of the service on the other. This confluence of public and private interests is due to the basic underlying economic principle that a monopolist at one stage of a vertical chain of production can extract *all* of the available monopoly profits without providing the full range of service components.[34] This is why the LEC's interests coincide with the public interest in social cost efficiency. Since its profit level is determined by the price explicitly or implicitly charged for the component over which it faces less competition and this profit is greater the lower the cost of the competitive component, the LEC has an incentive to allow the less competitive

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[34] The theorem applies when: (1) there is perfect competition downstream; (2) the monopoly component is used in fixed proportions in providing the final service; (3) no economic rents (profits) are earned at the competitive production stages; and (4) integration by the monopolist is not required to implement price discrimination. While demanding, these conditions are satisfied in the telecommunications sector, at least to a tolerable approximation. Moreover, the basic thrust of the analysis remains valid, even if the failure of one or more of the above assumptions requires some modification in detail. For more detailed discussions of this issue see, for example, Carlton and Perloff's *Modern Industrial Organization*, Chapter 16, or Viscusi, Vernon, and Harrington's *Economics of Regulation and Antitrust*, Chapter 8.

component to be combined with that of the least-cost provider for the competitive component. To do otherwise would not maximize its total profits. More importantly for our purposes, neither would such a policy minimize the total social costs of production. Thus the LEC has the incentive to pursue socially efficient policies with respect to the provision of competitive service components.

It will make the analysis clearest to consider an initial situation in which the LEC produces all service components and sells the final service to consumers at the established price p. (As we shall see, it makes no difference whether p is the unconstrained profit maximizing price or a regulated price chosen to yield only a fair rate of return.) For simplicity, suppose that it can produce the service at a *marginal* cost of $c = a + b$, where a and b are the LEC's marginal costs of producing the competitive and less-competitive components, respectively. Initially, then, the final service makes a contribution toward overhead cost recovery and/or profits of $n = p - c$ per unit.

Now suppose new entrants seek to provide the competitive service component to some or all of the LEC's final service customers. Suppose further that the entrants' unit cost of producing the competitive service component is constant and equal to a^c. At what price r should such entrants be allowed to purchase use of the LEC's less-competitive component? Consider first a "cost-based" approach in which access is made available at the LEC's marginal cost of b. Then competitors could afford to offer the completed service at a price of $\Pi = r + a^c = b + a^c$. If this is less than the incumbent's bundled price of p, then the incumbent will lose the business and contribution of those consumers the entrants elect to serve.[35]

Forgetting for the moment the impact on the incumbent's finances, would a policy of marginal cost based usage pricing lead to cost efficient provision of network services in a competitive environment? In general the answer is no. Under this policy, entrants will win business whenever $r + a^c = b + a$ is less than $p = n + c = n + b + a$. That is, the marginal cost pricing of usage allows entrants to capture the business whenever their unit costs are less than the sum of the incumbent's unit costs *plus* its unit contribution: i.e., whenever a^c is less than $a + n$. Yet from the point of view of cost efficiency, entrants should replace the incumbent only when their unit costs are below those of the incumbent: i.e., when a^c is less than a.

In Example 3 the incumbent's marginal costs of providing the less-competitive and competitive components were \$.10 and \$.05, respectively, while the initial price for the bundled service is \$.25. Then

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35 That the contribution is lost follows from the assumption that the less-competitive component is priced at its marginal cost b. The LEC recovers those costs, and saves the cost of providing the competitive component.

the service provides the incumbent a contribution of \$.10 = \$.25-\$.05-\$.10. With access to the less-competitive component set at the incumbent's marginal cost of \$.10, an entrant can undercut the established price of \$.25 as long as its cost of providing the competitive component are less than \$.15. Yet it is socially efficient for entrants to capture this business only when their costs are less than \$.05, the incumbent's marginal cost of producing the component in question. The policy of setting access rates equal to component marginal cost sounds sensible, but actually serves to encourage inefficient entry.

Let us now consider the outcome under ECP. In terms of the framework developed above, ECP requires that $r=p-a$. That is, the LEC implicitly offers potential competitors the final service price less the out-of-pocket costs which the incumbent saves by not having to provide the competitive component. First note that the LEC's contribution from each unit of final service is, indeed, preserved, regardless of who makes the final sale. If the incumbent keeps the business, its contribution per unit is, as before, given by $n=p-c=p-a-b$. If an entrant wins the business, the incumbent receives no final product sales revenues, but receives usage revenues of $r=p-a$, while incurring component costs of b per unit. The incumbent's net contribution earned by each unit of the less-competitive component sold is then given by $r-b=p-a-b=n$, as was the case initially.

ECP provides a firm methodological basis for pricing interconnection for competitors in the evolving "network of networks" as long as economies of scale prevent full competition and complete deregulation of local telecommunications services.

Appendix E

Optimal Pricing of Shared Infrastructure Facilities

There are three service demand functions (and associated prices) to consider: urban intraexchange service ($X(P)$), rural intraexchange service ($x(p)$), and joint service ($D(T)$). Here $T = J + j$ is the total price of the joint service, while J and j are, respectively, the amounts received by the urban and rural LECs. We assume that these demand functions are independent, with price elasticities denoted by Σ, σ, and δ. Let B denote the constant marginal cost of using the urban LEC's shared facilities and A the constant marginal cost of the competitive service component in the urban area, so that $C = A + B$ is the marginal cost of providing a unit of urban intraexchange service. Let c denote the marginal cost of rural intraexchange service, and b the marginal cost incurred by the rural LEC when providing a unit of the joint service.

Maximization of consumers' plus producers' surplus with respect to P, p, J, and j, subject to the constraint that *both* LECs at least break even, yields the following necessary conditions (in elasticity form):

$$(1)\quad (p\text{-}c)/p = \lambda/[(1+\lambda)\sigma]$$

$$(2)\quad (P\text{-}C)/P = \Lambda/[(1+\Lambda)\Sigma]$$

$$(3)\quad (J\text{-}B)/T + (j\text{-}b)(1+\lambda)/[T(1+\Lambda)] = \Lambda/[(1+\Lambda)\delta]$$

$$(4)\quad (j\text{-}b)/T + (J\text{-}B)(1+\Lambda)/[T(1+\lambda)] = \lambda/[(1+\lambda)\delta],$$

where Λ and λ are the constraint multipliers for the urban and rural LECs, respectively.

First note that the usage price charged a potential urban intraexchange competitor under ECP is given by $R = P\text{-}A$. We wish to compare this charge to J, the amount users of the joint service pay to the urban LEC. Both services incur marginal costs of B for their use of the shared facility. Since $C = A + B$, we can rearrange (2) to obtain:

$$(5)\quad (R\text{-}B) = P\Lambda/[(1+\Lambda)\Sigma].$$

Next, multiply (3) through by T to obtain

$$(6)\quad (J\text{-}B) = T\Lambda/[(1+\Lambda)\delta]\text{-}(j\text{-}b)(1+\lambda)/(1+\Lambda).$$

Subtracting (6) from (5) yields the expression which compares the access charges of interest:

$$(7)\quad R\text{-}J = [\Lambda/(1+\Lambda)][(P/\Sigma)\text{-}(T/\delta)] + (j\text{-}b)(1+\lambda)/(1+\Lambda).$$

When $\Sigma = \delta$ and $P = T$, the benchmark case discussed in the text, this reduces to:

$$(8)\quad R\text{-}J = (j\text{-}b)(1+\lambda)/(1+\Lambda) > 0.$$

CERTIFICATE OF SERVICE

I, Richard D. Massie, a secretary in the law firm of Koteen & Naftalin, do hereby certify that I have this date caused the foregoing to be sent by first class United States Mail, postage prepaid, to the following:

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December 16, 1993

/s/ Richard D. Massie